FORM PTO-1390
REV. 5-93

US DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEYS DOCKET NUMBER
P00,0938

U.S.APPLICATION NO. (if known, see 37 CFR 1.5)
09/530386

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE98/03134	**26 October 1998**	**27 October 1997**

TITLE OF INVENTION
METHOD, MOBILE STATION AND BASE STATION FOR CONNECTION SETUP IN A RADIO COMMUNICATION SYSTEM

APPLICANT(S) FOR DO/EO/US
Anja Klein, Michael Färber and Christian Lüders

Applicant herewith submits to the United States /Designated/Elected Office (DO/EO/US) the following items and other information:

1. ■ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. □ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ■ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay.
4. ■ A proper Demand for International Preliminary Examination will be made by the 19th month from the earliest claimed priority date.

5. ■ A copy of International Application as filed (35 U.S.C. 371(c)(2))
   a. ■ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. □ has been transmitted by the International Bureau.
   c. □ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ■ A translation of the International Application into English (35 U.S.C. 371(c)(2).

7. ■ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3))
   a. □ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. □ have been transmitted by the International Bureau.
   c. □ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ■ have not been made and will not be made.

8. □ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).

9. ■ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). **Executed**

10. □ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. □ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98; **(PTO 1449, Prior Art, Search Report).**

12. ■ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included. **(SEE ATTACHED ENVELOPE)**

13. ■ A FIRST preliminary amendment.
    □ A SECOND or SUBSEQUENT preliminary amendment.

14. □ A substitute specification.

15. □ A change of power of attorney and/or address letter.

16. ■ Other items or information:
    a. ■ Submission of Drawings - **Three sheets of Drawing - Submission of Corrected Drawings**

    b. ■ **EXPRESS MAIL #EL497037523US dated April 27, 2000.**

U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/530386	PCT/DE98/03134	P00,0938

BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO . . . . . $840.00 International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) . . $670.00 No international preliminary examination fee paid to USPTO (37 C.F.R. 1.482) but international search fee paid to USPTO (37 C.F.R. 1.445(a)(2) . . . . . $760.00 Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2) paid to USPTO . . . . . $970.00 International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) . . . . . $ 96.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$840.00	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).	$ 0	

Claims	Number Filed		Number Extra	Rate		
Total Claims	17	- 20 =		X $ 18.00	$0	
Independent Claims	3	- 3 =		X $ 78.00	$0	
Multiple Dependent Claims				$260.00 +	$	
				TOTAL OF ABOVE CALCULATIONS =	$840.00	
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 C.F.R. 1.9, 1.27, 1.28)					$	
				SUBTOTAL =	$	
Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +					$	
				TOTAL NATIONAL FEE =	$840.00	
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). $40.00 per property +						
				TOTAL FEES ENCLOSED =	$ 840.00	
				Amount to be refunded		$
				charged		$

a. ■ A check in the amount of $ 840.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **08-2290**. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Hill & Simpson
A Professional Corporation
85th Floor Sears Tower
Chicago, Illinois 60606

Brett A. Valiquet
SIGNATURE

Brett A. Valiquet
NAME

27,841
Registration Number

BOX PCT

IN THE UNITED STATES ELECTED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY-CHAPTER II

PRELIMINARY AMENDMENT

APPLICANT: **ANJA KLEIN ET AL**

DOCKET NO: P00,0938
SERIAL NO: GROUP ART UNIT:
EXAMINER:

INTERNATIONAL APPLICATION NO: PCT/DE98/03134
INTERNATIONAL FILING DATE: 26 October 1998
INVENTION: **"METHOD, MOBILE STATION AND BASE STATION FOR CONNECTION SETUP IN A RADIO COMMUNICATION SYSTEM"**

Assistant Commissioner for Patents,
Washington, D.C. 20231

Sir:

As a Preliminary Amendment for entry into the National Stage for the above-identified PCT application, the following is submitted:

IN THE SPECIFICATION:

Please amend the specification as follows:

On page 1, delete line.

On page 1, before the title, insert

--S P E C I F I C A T I O N

TITLE--;

after the title, as a separate line, insert

--**BACKGROUND OF THE INVENTION**--.

On page 1, at line 18, delete "ensues" and substitute --occurs--.

On page 1, at line 24, delete "ensue" and substitute --occur--.

On page 2, after line 5 and before line 6 insert the following title:

--**SUMMARY OF THE INVENTION**--.

On page 2, at line 9, delete "by the method" and substitute the following:

--according to the method of the present invention for connection setup for mobile stations of a radio communication system having at least one base station, frequency channels for a random access are recurrently offered in an upstream direction for the mobile stations. With the mobile station that requests a connection setup, a reception power of a signal sent from the base station in a downstream direction is measured. With the mobile station, a transmission power dependent on the measured reception power for sending an access radio block to the base station is set. A mobile station and a base station are provided for implementation of the above method.--

On page 2, delete lines 10 through 13.

On page 2, at line 21, delete "ensue" and substitute --occur--.

On page 2, at line 23, delete "ensuing" and substitute --occurring--.

On page 2, at line 26, delete "ensue" and substitute --occur--.

On page 4, at line 9, after "in" insert --the--.

On page 4, at line 13, before "downstream" insert --the--.

On page 4, delete line 27 and insert the following heading:

--BRIEF DESCRIPTION OF THE DRAWING--

On page 4, at line 28, after "FIG. 1" insert --is--.

On page 4, at line 29, before "mobile" insert --a--.

On page 4, at line 30, after "FIG. 2" insert --is--.

On page 5, at line 1, after "FIG. 3" insert --is--.

On page 5, at line 3, after "FIG. 4" insert --shows--, before "mobile" insert --the--, before "base" insert --the--.

On page 5, after line 3, and before line 4, insert the following heading:

--DESCRIPTION OF THE PREFERRED EMBODIMENTS--.

On page 5, at line 6, delete "network" and substitute --networked--.

On page 5, at line 19, delete "initiated" and substitute --initiate--.

On page 5, at line 19, before "upstream" insert --the--.

On page 5, at line 25, delete "Inventively" and substitute --According to the invention,--.

On page 5, at line 27, before "downstream" insert --the--.

On page 5, at line 30, delete "means" and substitute --unit--.

On page 5, at line 31, delete "means SP" and substitute --unit ST--.

On page 6, at line 2, delete "means" and substitute --unit--.

On page 6, at line 3, after "solutions" insert -- - --.

On page 6, at line 7, delete "means" and substitute --unit--.

On page 6, at line 16, before "downstream" insert --the--.

On page 6, at line 18, delete "means" and substitute --unit--.

On page 6, at line 19, delete "means" and substitute --unit--.

On page 7, at line 19, before "other" insert --the--.

On page 9, at line 12, delete "ensued" and substitute --occurred--.

On page 9, at the last line, delete "means" and substitute --unit-- (both occurrences).

On page 10, at line 3, delete "means" and substitute --unit--.

On page 10, at line 4, delete "means" and substitute --unit--, delete "[sic]".

On page 10, at line 5, delete "means" and substitute --unit-- (both occurrences).

On page 10, at line 9, delete "means" and substitute --unit--.

On page 10, at line 10, delete "means" and substitute --unit--.

On page 10, at line 11, delete "communicate" and substitute --communicates--.

On page 10, at line 12, delete "means" and substitute --unit--.

On page 10, at line 13, delete "ensues" and substitute --occurs--.

On page 10, at line 17, delete "means" and substitute --unit--.

On page 10, at line 20, delete "means" and substitute --unit-- (both occurrences).

On page 10, at line 26, delete "means" and substitute --unit--.

On page 10, at line 30, delete "[sic]".

On page 10, at line 31, delete "means" and substitute --unit--.

On page 11, at line 3, delete "means" and substitute --unit--.

On page 11, as the last paragraph, insert the following paragraph:

--Although various minor changes and modifications might be proposed by those skilled in the art, it will be understood that my wish is to include within the claims of the patent warranted hereon all such changes and

modifications as reasonably come within my contribution to the art.--

IN THE ABSTRACT:

Please amend the Abstract as follows:

In line 5, delete "having" and substitute --has--.

In line 5, delete "(BS)".

In line 6, delete "offers" and substitute --offering--, delete "(MS)", after "in" insert --an--.

In line 8, delete "(rp)", delete "(ss)", before "downstream" insert --a--.

In line 9, delete "(BS)", delete "(tp)".

In line 10, delete "(rab)".

In line 15, delete "ensued" and substitute --occurred--.

Delete line 17.

IN THE DRAWINGS:

Please amend the drawings as indicated in the attached Submission of Corrected Drawings.

IN THE CLAIMS:

On page 12 of the claims, line 1, please change "PATENT CLAIMS" to --**WE CLAIM AS OUR INVENTION**--.

Please cancel claims 1-17 without prejudice.

Please add new claims 18-34 as follows:

18. A method for connection setup for mobile stations of a radio communication system having at least one base station, comprising the steps of:

recurrently offering frequency channels for a random access in an upstream direction for the mobile stations;

with the mobile station that requests a connection setup, measuring a reception power of a signal sent from the base station in a downstream direction; and

with the mobile station, setting a transmission power dependent on the measured reception power for sending an access radio block to the base station.

19. The method according to claim 18 wherein the radio communication system is configured as a TDMA/CDMA radio communication system, whereby information of a plurality of connections are simultaneously transmitted between the mobile stations and the base station in frequency channels formed by time slots, whereby the information of different connections can be distinguished from one another according to a connection-individual fine structure.

20. The method according to claim 19 wherein the information of different connections are spread with individual codes.

21. The method according to claim 18 wherein the mobile station sets the transmission power all the higher the lower the measured reception power is.

22. The method according to claim 18 wherein the signal transmitted in the downstream direction is a pilot signal.

23. The method according to claim 18 wherein the signal transmitted in the downstream direction is a control signal transmitted on a BCCH channel.

24. The method according to claim 18 wherein the signal transmitted in the downstream direction is a training sequence signal.

25. The method according to claim 18 wherein the signal transmitted in the downstream direction is a data signal.

26. The method according to claim 18 wherein the mobile station estimates a radio field attenuation in the downstream direction on the basis of the measured reception power and sets the transmission power such that the radio field attenuation is at least partially compensated.

27. The method according to claim 26 wherein the mobile station sets the transmission power such that the radio field attenuation is completely compensated.

28. The method according to claim 18 wherein at least one auxiliary information is inserted into the signal sent in the downstream direction, this being

employed by the mobile station for setting the transmission power.

29. The method according to claim 28 wherein the auxiliary information is composed of an information about the transmission power used by the base station in the downstream direction.

30. The method according to claim 18 wherein a broadband frequency range is divided into sub-ranges having a narrower bandwidth within a frequency channel for the random access, the mobile station that requests the connection setup selecting a sub-range within said frequency channel, and the mobile station sending the access radio block to the base station in this sub-range.

31. The method according to claim 18 wherein the access radio block is not spread.

32. The method according to claim 18 wherein the access radio block is spread with an individual code.

33. A mobile station to which a connection setup is to be provided in a radio communication system having at least one base station, and wherein frequency channels are recurrently offered for a random access in an upstream direction for the mobile station, comprising:

a measuring unit for measuring a reception power of a signal sent from the base station in a downstream

direction when the mobile station requests a connection setup;

a transmission power setting unit which, dependent on measured reception power, sends an access radio block to the base station;

a control panel for triggering the random access;

said measuring unit comprising a signal processing unit for measuring the reception power of the signal sent in the downstream direction from the base station and for generating the access radio block; and

said transmission power setting unit comprising a control unit for setting the transmission power for the transmission of the access radio block to the base station dependent on the measured reception power.

34. A base station in a radio communication system wherein a connection setup occurs from mobile stations, and wherein the mobile station that requests a connection setup measures a reception power of a signal sent from the base station in a downstream direction, and wherein the mobile station sets a transmission power dependent on the measured reception power for sending an access radio block to the base station, comprising:

a unit for recurrently offering frequency channels for a random access in an upstream direction for the mobile stations;

a signal processing unit for generating the signal to be transmitted in the downstream direction; and

a control unit for setting a transmission power for sending the signal to the mobile station that requests the connection setup.

REMARKS

The specification, drawings and abstract have been amended in accordance with U. S. practice.

Also, new claims presented in accordance with U.S. practice are presented herewith, generally corresponding to those prosecuted in the PCT phase.

Respectfully submitted,

Brett A Valiquet (Reg.No. 27,841)

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BOX PCT

IN THE UNITED STATES ELECTED OFFICE

OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

UNDER THE PATENT COOPERATION TREATY-CHAPTER II

SUBMISSION OF FORMAL DRAWINGS

APPLICANT: **ANJA KLEIN ET AL**

DOCKET NO: P00,0938

SERIAL NO: GROUP ART UNIT:

EXAMINER:

INTERNATIONAL APPLICATION NO: PCT/DE98/03134

INTERNATIONAL FILING DATE: 26 October 1998

INVENTION: **"METHOD, MOBILE STATION AND BASE STATION FOR CONNECTION SETUP IN A RADIO COMMUNICATION SYSTEM"**

Assistant Commissioner for Patents

Washington, D.C. 20231

Sir:

Please amend the figures 1 and 4 as indicated in red on the attached drawing copies.

Respectfully submitted,

(Reg.No. 27,841

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Attorneys for Applicant

FIG 1

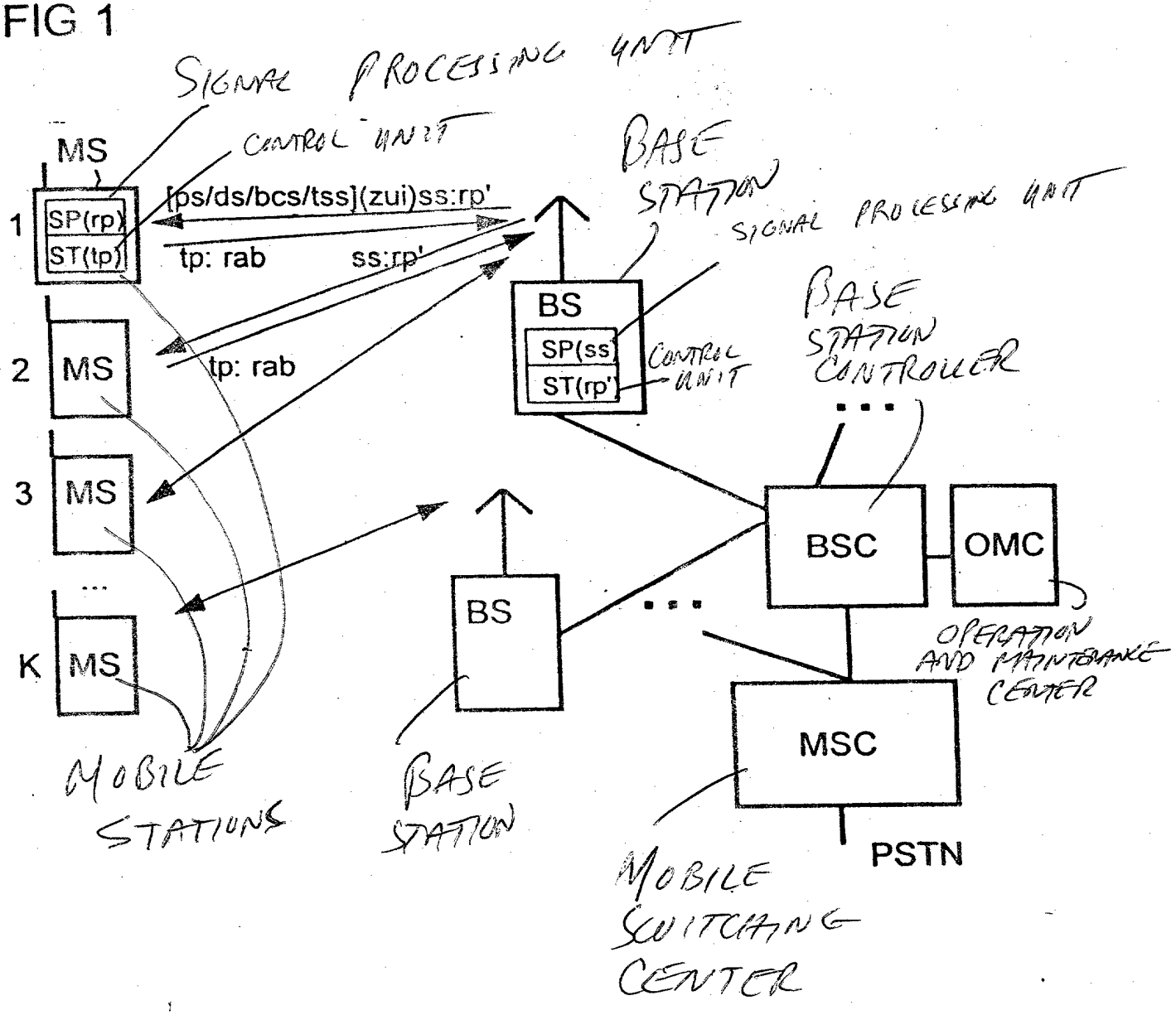

SIGNAL PROCESSING UNIT
CONTROL UNIT
BASE STATION
SIGNAL PROCESSING UNIT
MS
1
SP(rp)
ST(tp)
[ps/ds/bcs/tss](zui)ss:rp'
tp: rab
ss:rp'
BS
SP(ss)
ST(rp')
CONTROL UNIT
BASE STATION CONTROLLER
2 MS
tp: rab
3 MS
BSC
OMC
BS
K MS
OPERATION AND MAINTENANCE CENTER
MSC
PSTN
MOBILE STATIONS
BASE STATION
MOBILE SWITCHING CENTER

FIG 3

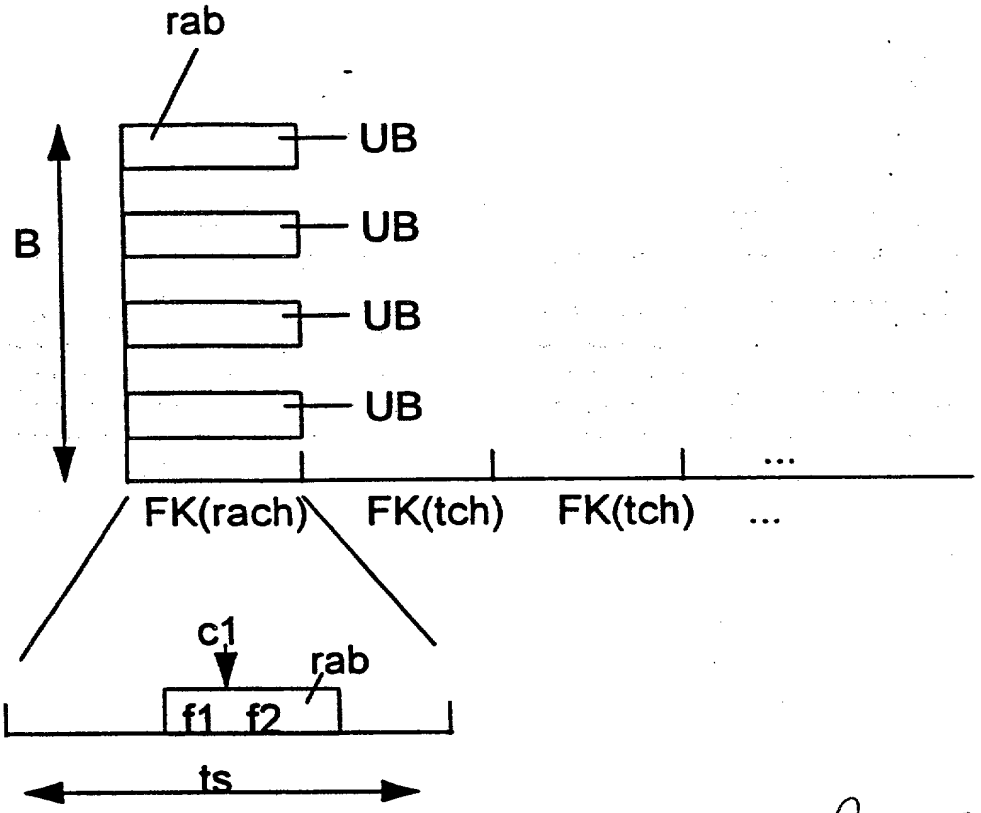
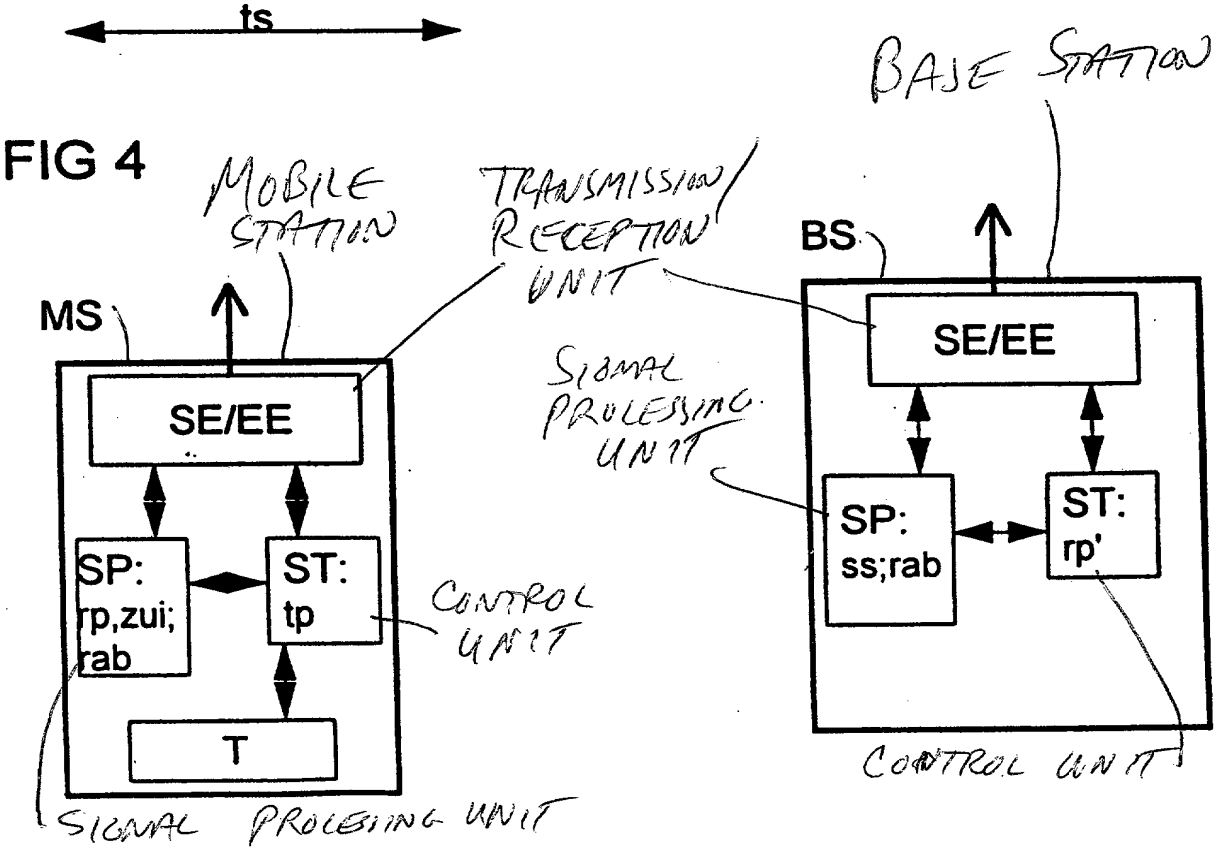

rab
UB
UB
UB
UB
B
...
FK(rach)
FK(tch)
FK(tch)
...
c1
rab
f1 f2
ts

FIG 4


BASE STATION
MOBILE STATION
TRANSMISSION/ RECEPTION UNIT
BS
MS
SE/EE
SIGNAL PROCESSING UNIT
SE/EE
SP: rp,zui; rab
ST: tp
CONTROL UNIT
SP: ss;rab
ST: rp'
T
SIGNAL PROCESSING UNIT
CONTROL UNIT

PCT WELTORGANISATION FÜR GEISTIGES EIGENTUM
Internationales Büro

INTERNATIONALE ANMELDUNG VERÖFFENTLICHT NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT)

(51) Internationale Patentklassifikation 6 :		(11) Internationale Veröffentlichungsnummer: **WO 99/22462**
H04B 7/005, H04Q 7/38	**A1**	(43) Internationales Veröffentlichungsdatum: 6. Mai 1999 (06.05.99)

(21) Internationales Aktenzeichen: PCT/DE98/03134

(22) Internationales Anmeldedatum: 26. Oktober 1998 (26.10.98)

(30) Prioritätsdaten:
197 47 451.9 27. Oktober 1997 (27.10.97) DE

(71) Anmelder *(für alle Bestimmungsstaaten ausser US)*: SIEMENS AKTIENGESELLSCHAFT [DE/DE]; Wittelsbacherplatz 2, D–80333 München (DE).

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(81) Bestimmungsstaaten: AU, BR, CA, CN, HU, ID, IL, JP, KR, MX, NO, PL, RU, UA, US, VN, eurasisches Patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

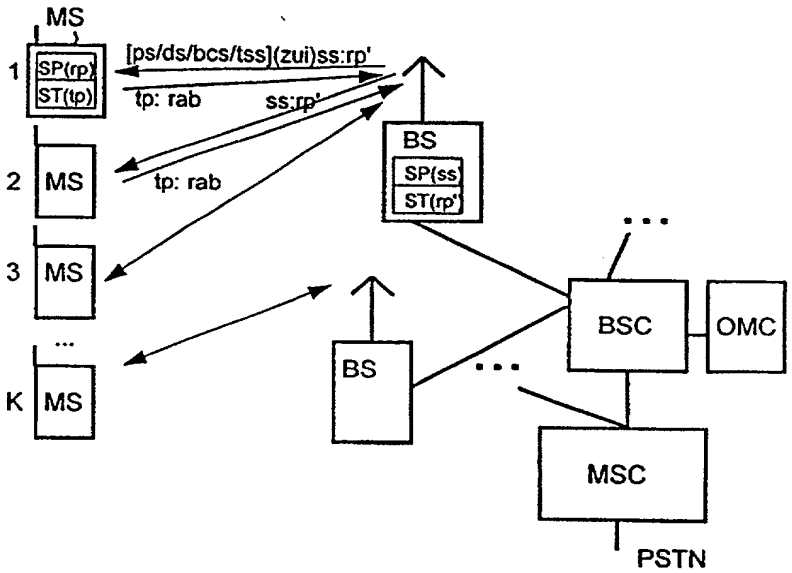
Veröffentlicht
Mit internationalem Recherchenbericht.
Vor Ablauf der für Änderungen der Ansprüche zugelassenen Frist; Veröffentlichung wird wiederholt falls Änderungen eintreffen.

(54) Title: METHOD, MOBILE STATION AND BASE STATION FOR ESTABLISHING CONNECTIONS IN A RADIOCOMMUNICATIONS SYSTEM

(54) Bezeichnung: VERFAHREN, MOBILSTATION UND BASISSTATION ZUM VERBINDUNGSAUFBAU IN EINEM FUNK–KOMMUNIKATIONSSYSTEM

(57) Abstract

A radiocommunications system, for example a TDMA/CDMA radiocommunications system with at least one base station (BS) prepares frequency channels returning in an uplink direction for a random access for mobile stations (MS). A received power (rp) of a signal (ss), said signal being transmitted from the base station (BS) in a downlink direction, is measured by the mobile station which requests a connection setup, and a transmitter power (tp) is adjusted in order to transmit a radio access block (rab) to the base station according to the measured received power. A variable transmitter power control can be carried out at the mobile station with the assistance of the measured received power of the signal transmitted at the base station as well as for the random access of the mobile station which until now has always occurred with a maximum transmitter power.



SPECIFICATION

METHOD, MOBILE STATION AND BASE STATION FOR CONNECTION SETUP IN A RADIO COMMUNICATION SYSTEM

The invention is directed to a method for connection setup before a mobile station of a radio communication system as well as to a mobile station configured in this way and to a base station.

The establishment of digital radio communication systems is disclosed in J. Oudelaar, "Evolution Towards UMITS", PIMRC 94, 5th IEEE International Symp. on Personal, Indoor and Mobile Radio Communications, the Hague, NL, 18 through 22 September 1994, pages 852 through 856, and M. Lenti, H. Hageman, "Paging in UMTS", RACE Mobile Telecommunications Workshop, Vol. 1, Amsterdam, NL, 17 through 19 May 1994, pages 405 through 410.

The presently existing mobile radio telephone system GSM (Global System for Mobile Communications) is a radio communication system with a TDMA component for subscriber separation (time-division multiple access). Payload information of the subscriber connections are transmitted in time slots according to a frame structure. The transmission ensues block-by-block. Frequency channels adapted to the time grid of the frame structure (RACH random access channel) are also known from the GSM mobile radio telephone system for arbitrary access for the mobile stations. A mobile station that requests a connection setup can send an access radio block in this frequency channel without a frequency channel having been previously allocated to the mobile station. A transmission power control cannot ensue given random access, since the transmission conditions are not yet known at the transmitter side. A mobile station therefore usually sends with maximum transmission power for the radio cell. Maximum transmission power is also selected in order to assure that a mobile station located at the edges of the radio cell that transmits an access radio block generates a signal at the base station that is strong enough for a detection. When a plurality of mobile stations simultaneously actuate the random access in the

same time slot and frequency band, radio blocks lower in power would not be capable of being interpreted and would have to be re-transmitted at a later point in time by the affected mobile stations. When two or more signals having nearly the same power intensity arrive, both signals may possibly not be detected and must be re-initiated.

The invention is based on the object of offering a method and devices that enable the connection setup for the random access of the mobile stations in a radio communication system given optimally effective utilization of the radio-oriented resources. This object is achieved by the method comprising the features of patent claim 1, the mobile station comprising the features of patent claim 16 and the base station comprising the features of patent claim 17. Developments of the invention can be derived from the subclaims.

The radio communication system having at least one base station provides that frequency channels for a random access be offered in recurring fashion for the mobile stations in upstream direction. A reception power of a signal transmitted in downstream direction from the base station is measured by the mobile station that requests a connection setup, and a transmission power for sending an access radio block to the base station is set dependent on the measured reception power.

A flexible transmission power control can thus ensue at the side of the mobile station with the assistance of the measured reception power of the signal transmitted at the base station side, this also ensuing for the random access of the mobile station, this having hitherto not been available. As a result of the setting of the transmission power for the random access, a plurality of such accesses can simultaneously ensue from different mobile stations without the other signals that are active in the same frequency band or on neighboring carriers being thereby disturbed or possibly being no longer detected. Neighboring channel interferences are reduced or, respectively, eliminated by the flexible power control for the access radio block or blocks, which need not be transmitted with maximum transmission power in every case. Due to the increased rate of successful detections of

the access radio blocks that are transmitted - equivalent with a lower rate of reoccurring access attempts due to inadequate detection - , the radio-oriented resources are utilized better. Overall, the connection setup is also accelerated since fewer access attempts of the mobile station are needed until a successful connection setup has been achieved.

The invention can be particularly advantageously employed in a TD/CDMA radio communication system, since the access radio block is active in the same frequency band simultaneously with other payload signals - for example, traffic data or signalling information or organization information. The information of various connections can thereby be distinguished from one another and a frequency channel formed by the time slots on the basis of a connection-individual fine structure. This fine structure preferably comprises codes with which the individual subscriber signals are spread.

Over and above this, the invention leads to advantages where the principle of random access is modified such that the multiple access - preferably according to TD/CDMA - also occurs on neighboring carriers, so that high neighboring channel interferences are to be expected at the base station side given highly different reception powers of the different access radio blocks. It is precisely this that can be avoided by the invention, since great differences in the reception power are - from the point of view of the base station - compensated by the flexible transmission power control in the mobile station.

The above advantage derives when, according to a development of the invention, a broadband frequency range is divided into sub-ranges with narrower bandwidth within the frequency channel for the random access, the mobile station that requests the connection setup selecting one sub-range within the frequency channel and sending the access radio block to the base station in this sub-range.

In the transmission of the access radio block, this can be spread with an individual code at the transmitter side, so that a plurality of random accesses can also occur as warranted in one sub-range. Advantageously,

the individual code represents the random number of the access block and can be selected from a set of allowed codes that are known to the receiving station. Alternatively thereto, it can be provided that the access radio block is not spread. The evaluation thereof is facilitated.

According to another development of the invention, the transmission power is set all the higher by the mobile station the lower the measured reception power is. The mobile station can thus optimally adapt the power to the conditions of the transmission link.

It has proven advantageous to estimate a radio field attenuation in downstream direction with the mobile station on the basis of the measured reception power, and to set the transmission power such that the radio field attenuation is at least partially compensated.

The signal transmitted in downstream direction with reference whereto the reception power can be measured can be a training sequence signal, a data signal, a pilot signal or a control signal transmitted on the BCCH channel according to advantageous developments.

It is also advantageous when at least one auxiliary information is inserted into the signal transmitted in downstream direction, this being employed by the mobile station for setting the transmission power. The auxiliary information is preferably composed of an information about the transmission power used by the base station in downstream direction. The mobile station thus receives an information that it can directly employ for setting the transmission power suitable for the individual case and that it can additionally interpret for measuring the reception power.

The invention is explained in greater detail below on the basis of an exemplary embodiment with reference to graphic illustrations.

Thereby shown are:

FIG. 1 a block circuit diagram of a mobile communication system for connection setup for random accesses of mobile station;

FIG. 2 a schematic illustration of the frame structure for the radio transmission;

FIG. 3 a schematic illustration of the division or frequency channel for random access into sub-ranges; and

FIG. 4 block circuit diagrams of mobile station and base station.

In terms of structure, the mobile communication shown in FIG. 1 corresponds to a known GSM mobile radio telephone system that comprises a plurality of mobile switching centers MSC that are network with one another or, respectively, that produce the access to a fixed network PSTN. Further, these mobile switching centers MSC are respectively connected to at least one base station controller BSC. Each base station controller BSC in turn enables a connection to at least one base station BS. Such a base station BS is a radio station that can setup message connections to mobile stations MS via a radio interface. An operation and maintenance center OMC realizes operation and maintenance functions for the mobile radio telephone network or, respectively, for parts thereof. Three connections for transmitting payload information and signalling information between three mobile stations MS1, MS2, MS3 and a base station BS are shown by way of example in FIG. 1. The functionality of this structure can be transferred onto other radio communication systems wherein the invention can also be utilized.

The mobile stations MS can initiated a random access in upstream direction on their own without a frequency channel having been previously allocated to the mobile station. For supporting the random access, the system respectively offers frequency channels (rach, random access channel) adapted to the time grid of a frame structure used for radio transmission. A mobile station that requests a connection setup can send an access radio block rab in this frequency channel. Inventively, the mobile station MS that requests a connection setup measures the reception power rp of a signal ss sent in downstream direction from the base station BS, and sets a transmission power tp for sending the access radio blocks rab dependent on the measured reception power rp. The signal ss is made available to the base station BS by a signal processing means SP, is provided with a transmission power rp' by a control means SP of the base station BS, and is transmitted to the mobile station via the radio interface.

The signal ss with reference whereto the reception power rp can be measured by a signal processing means SP of the mobile station MS can - according to advantageous solutions, be a training sequence signal tss given employment of a TD/CDMA radio transmission (see FIG. 2), a data signal ds, a pilot signal ps or a control signal bsc transmitted on the BCCS channel (broadcast channel). The transmission power tp for the access radio block rab is preferably set all the higher by a control means ST of the mobile station MS the lower the reception power rp measured by the signal processing means SP is.

Additionally, there is the version for the mobile station MS to have an auxiliary information zui inserted into the signal ss by the base station BS and transmitted via the radio interface interpreted by the signal processing means SP in order to have optimally many parameters available for transmission power control for the random access. The auxiliary information zui, which is preferably composed of an information about the transmission power rp' set in downstream direction is used at the mobile station side for setting the transmission power for sending the access radio block rab.

In collaboration with the control means ST, the signal processing means SP implements an estimation of the radio field attenuation of the connection between base station BS and mobile station MS on the basis of the measured reception power rp, implementing this over and above the former. The transmission power tp is subsequently set such that the identified radio field attenuation can be at least partially compensated. A complete compensation control of the radio field attenuation is likewise possible. The overall attenuation of the transmission channel employed is composed of a separation attenuation, of the shadowing and of the rapid fade. A limited leveling of the radio field attenuation estimated from measuring the power has the advantage with respect to the two first-cited cases that other signals that are simultaneously active in the same frequency band - such as, for example, payload information (see FIG. 2) or further access radio blocks (see FIG. 3) - are only slightly disturbed by the transmitted access radio block rab. When, despite the power setting taking

the momentary transmission conditions into consideration, the random access has not been detected at the initial attempt - for example, due to a currently strong attenuation given rapid fade-, a renewed random access can be initiated by the mobile station MS with slightly increased transmission power tp.

The above comments apply correspondingly to other mobile stations MS that wish to start the random access simultaneously or offset in time. The method of the invention yields advantages precisely when a plurality of mobile stations actuate the random access in the same time slot and frequency band in which other signals are active. A transmission of the access radio block rab with maximum transmission power would result in extreme interference and a non-detection of these other signals. This disadvantage can be avoided by the flexible control of the transmission power tp for sending the access radio block rab in each mobile station dependent on the measured reception power of the received signal ss on the individual connection.

The frame structure of the radio transmission is described in FIG. 2 with reference to the example of a combined TD/CDMA method but can also be applied without further ado to other radio transmission method - for example, continuous methods such as DS-CDMA (direct sequence CDMA). The invention is also not limited thereto that a plurality of connections simultaneously exist between mobile stations and one or more base stations. The signals also need not be capable of being distinguished from one another by a connection-individual fine structure; rather, for example, they can be separated by time slots. According to a TDMA component of the TD/CDMA method, a division of a broadband frequency range B - for example, B = 1.6 MHz - into a plurality of time slots ts, for example eight time slots ts1 through ts8, is provided. Each time slot ts within the frequency range B forms a frequency channel FK. Information of a plurality of connections are transmitted in radio blocks within frequency channels FK (tch) that are provided for payload data transmission. These radio blocks for payload data transmission are composed of sections having data d in which

sections having training sequences tseq1 through tseqK known at the reception side are embedded. The data d are connection-individually spread with a fine structure, a subscriber code c, so that, for example K connections can be separated by these CDMA components at the reception side.

The spread of individual symbols of the data d effects that Q chips having the duration T_{chip} are transmitted within the symbol duration T_{sym}. The Q chips thereby form the connection-individual subscriber code c. A guard time gp for compensation of different signal running times of the connections is also provided within the time slots ts.

The successive time slots ts are divided according to a frame structure within a broadband frequency range B. Thus, eight time slots ts are combined into a frame, whereby, for example, one time slot ts4 of the frame forms a frequency channel FK (tch) for payload data transmission and is recurringly used by a group of connections. One frequency channel FK (rach) for the random access of the mobile stations MS is not offered in each frame but is offered at a predetermined point in time within a multi-frame. The spacings between the frequency channels FK (rach) for the random access determine the capacity that the mobile communication system makes available for this part of the connection setup. According to the exemplary embodiment, the transmission of the access radio block rab is provided in the time slot ts1. The signal sent in downstream direction for measuring the reception power and that is employed by the mobile station for setting the transmission power can be taken in a simple way as data signal ds from the data d or as training sequence signals tss of the training sequence of a radio block transmitted in downstream direction, so that no additional seizure of radio-oriented resources is required for this purpose.

FIG. 3 shows the structure of the frequency channel FK (rach) for random access. The broadband frequency range B = 1.6 MHz that, for example, is calculated from the frequency band of an organization channel of the mobile communication system charged with the duplex spacing, contains four sub-ranges UB each having a respective bandwidth of, for example, 200 kHz that are respectively separated by a range of 200 kHz in

order to reduce mutual disturbances. Access radio blocks rab can be sent within the sub-ranges UB as needed by mobile stations MS without prior allocation at the network side and without spreading. Access radio blocks according to the GSM standard can thus be employed. Given an alternative division of the frequency channel FK(rach) for random access, a total of eight sub-ranges UB are realized; these can overlap in terms of frequency. For better discrimination, the access radio block rab are spread with an individual code c1 but can also be fundamentally transmitted without spread.

The access radio block rab is shorter compared to the radio blocks for payload data transmission according to FIG. 2, the guard time is lengthened. This is necessary in order to assure a reliable reception in the base station BS despite the time synchronization having not yet ensued. The access radio block rab is beamed out with the transmission power that can be variably set according to the invention. The access radio blocks rab contains a bit sequence f1 known at the reception side for time synchronization and contains a random number f2. On the basis of the known bit sequence f1, the base station BS can determine the presence of an access radio block rab and can undertake a first time synchronization from the point in time of the arrival. The random number f2 selected by the mobile station MS, which can simultaneously represent a reference to the individual code c for spreading the access radio block rab, is used as reference for the following allocation of a frequency channel FK for further signalling for the connection setup. The mobile station MS can recognize the allocation addressed to it with this random number f2.

FIG. 4 shows the structure of a mobile station MS as well as of a base station BS with the devices required for the invention. The base station BS can detect and evaluate the access radio blocks transmitted in the frequency channels for the random access and can undertake a subscriber separation and a detection of the subscriber data for the payload information transmitted in the frequency channels.

The mobile station MS contains a control panel T, a signal processing means SP, a control means ST and a transmission/reception means SE/EE.

The subscriber can undertake inputs at the control panel T, including an input for a connection setup request. An access radio block rab is formed in the signal processing means SP and is transmitted via the transmission/reception means SE/EE with the transmission power rp [sic] set in the control means ST. The control means ST selects the sub-ranges within the nearest possible frequency channel for random access according to the above-described principles. The access radio block rab - following a corresponding signal editing - is sent narrow-band in the selected sub-range by the transmission means SE. Previously, the signal processing means SP interprets the signal ss that has arrived via the transmission/reception means SE/EE, in that it measures the reception power rp thereof and communicate this to the control means ST. For example, the measurement of the reception power ensues by summing up the squares of the samples of the received signals ss - in the digital - or by integration over the squares of the signal amplitudes - in the analog - or by summing up the estimated samples of the channel pulse response. This is carried out in the signal processing means SP. The determination of an estimated value for the reception power can also be interpreted as measurement. The auxiliary information zui potentially contained in the signal ss is likewise interpreted by the signal processing means SP and made available to the control means ST for controlling the transmission power.

The base station BS contains a transmission/reception means SE/EE that amplifies reception signals, converts them into the base band and demodulates them or, respectively, that modulates transmission signals like the signal ss and edits them for the high-frequency emission. A signal processing means SP that, for example, comprises a GD processor as digital signal processor for detecting arriving payload information and signalling information according to the JD-CDMA method (joint detection) also interprets the access block or blocks rab. The signal ss that is to be beamed out in downstream direction is provided with the transmission power rp' [sic] by a control means ST and is incorporated into a radio block according to FIG. 2 as data signal or training sequence signal. When this is a matter of

a pilot signal, it is sent independently of a payload data transmission - preferably continuously. Given employment of the BCCH control signal, the signal ss is incorporated as control signal by the control means ST and, for example, is sent to the mobile station MS as organization information.

The separation of the various sub-ranges ensues with a filter bank and an individual interpretation of the access block rab in the respective sub-ranges subsequently ensues. Alternatively, a prior low-pass filtering can be foregone and a detection can be implemented broad-band with a single user interpretation or with a joint detection interpretation.

The interpretation ensues by determining the correlation between the received signals and the bit sequences known in the base station BS (see FIG. 3). The point-in-time of the greatest correlation is thereby also identified, this serving subsequently for time synchronization. Alternatively, a signal-adapted filtering or some other linear algorithm (for example, according to the zero forcing or the minimum square error criterion) can also be applied.

PATENT CLAIMS

1. Method for connection setup for mobile stations (MS) of a radio communication system having at least one base station (BS), whereby

- frequency channels (FK) (rach)) for a random access are recurrently offered in upstream direction for the mobile stations (MS);
- the mobile station (MS) that requests a connection setup measures a reception power (rp) of a signal (ss) sent from the base station (BS) in downstream direction; and
- the mobile station (MS) sets a transmission power (tp) dependent on the measured reception power (rp) for sending an access radio block (rab) to the base station (BS).

2. Method according to claim 1, whereby the radio communication system is configured as TDMA/CDMA radio communication system, whereby information of a plurality of connections are simultaneously transmitted between the mobile stations (MS) and the base station (BS) in frequency channels (FK) formed by time slots (ts), whereby the information of different connections can be distinguished from one another according to a connection-individual fine structure.

3. Method according to claim 2, whereby the information of different connections are spread with individual codes (c).

4. Method according to one of the preceding claims, whereby the mobile station (MS) sets the transmission power (tp) all the higher the lower the measured reception power (rp) is.

5. Method according to one of the preceding claims, whereby the signal (ss) transmitted in downstream direction is a pilot signal (ps).

6. Method according to one of the claims 1 through 4, whereby the signal (ss) transmitted in downstream direction is a control signal (bcs) transmitted on the BCCH channel.

7. Method according to one of the claims 1 through 4, whereby the signal (ss) transmitted in downstream direction is a training sequence signal (tss).

8. Method according to one of the claims 1 through 4, whereby the signal (ss) transmitted in downstream direction is a data signal (ds).

9. Method according to one of the preceding claims, whereby the mobile station (MS) estimates a radio field attenuation in downstream direction on the basis of the measured reception power (rp) and sets the transmission power (tp) such that the radio field attenuation is at least partially compensated.

10. Method according to claim 9, whereby the mobile station (MS) sets the transmission power (tp) such that the radio field attenuation is completely compensated.

11. Method according to one of the preceding claims, whereby at least one auxiliary information (zui) is inserted into the signal (ss) sent in downstream direction, this being employed by the mobile station (MS) for setting the transmission power (tp).

12. Method according to claim 11, whereby the auxiliary information (zui) is composed of an information about the transmission power (rp' [sic]) used by the base station (BS) in downstream direction.

13. Method according to one of the preceding claims, whereby a broadband frequency range (B) is divided into sub-ranges (UB) having a

narrower bandwidth within the frequency channel (FK (rach)) for the random access, the mobile station (MS) that requests the connection setup selects a sub-range (UB) within the frequency channel (FK)(rach)), and the mobile station (MS) sends the access radio block (rab) to the base station (BS) in this sub-range (UP).

14. Method according to one of the preceding claims, whereby the access radio block (rab) is not spread.

15. Method according to one of the claims 1 through 13, whereby the access radio block (rab) is spread with an individual code (c1).

16. Mobile station (MS) for the implementation of the method according to claim 1, comprising

- a control panel (T) for triggering the random access;
- a signal processing means (SP) for measuring the reception power (rp) of the signal (ss) sent in downstream direction from the base station (BS) and for generating the access radio block (rab);
- a control means (ST) for setting the transmission power (tp) for the transmission of the access radio block (rab) to the base station (BS) dependent on the measured reception power (rp).

17. Base station (BS) for the implementation of the method according to claim 1, comprising:

- a signal processing means (SP) for generating the signal (ss) to be transmitted in downstream direction;
- a control means (ST) for setting a transmission power (rp'[sic]) for sending the signal (ss) to the mobile station (MS) that requests the connection setup.

ABSTRACT

Method, Mobile Station And Base Station For Connection Setup In A Radio Communication System

A radio communication system, for example a TDMA/CDMA radio communication system, having at least one base station (BS) recurringly offers frequency channels for a random access for mobile stations (MS) in upstream direction. The mobile station that requests a connection setup measures a reception power (rp) of a signal (ss) sent in downstream direction by the base station (BS) and sets a transmission power (tp) for sending an access radio block (rab) to the base station dependent on the measured reception power. A variable transmission power control can thus be implemented at the mobile station side with the assistance of the measured reception power of the signal transmitted on the part of the base station, being also capable of being implemented for random access of the mobile stations, this having previously always ensued with maximum transmission power.

FIG. 1

FIG 1

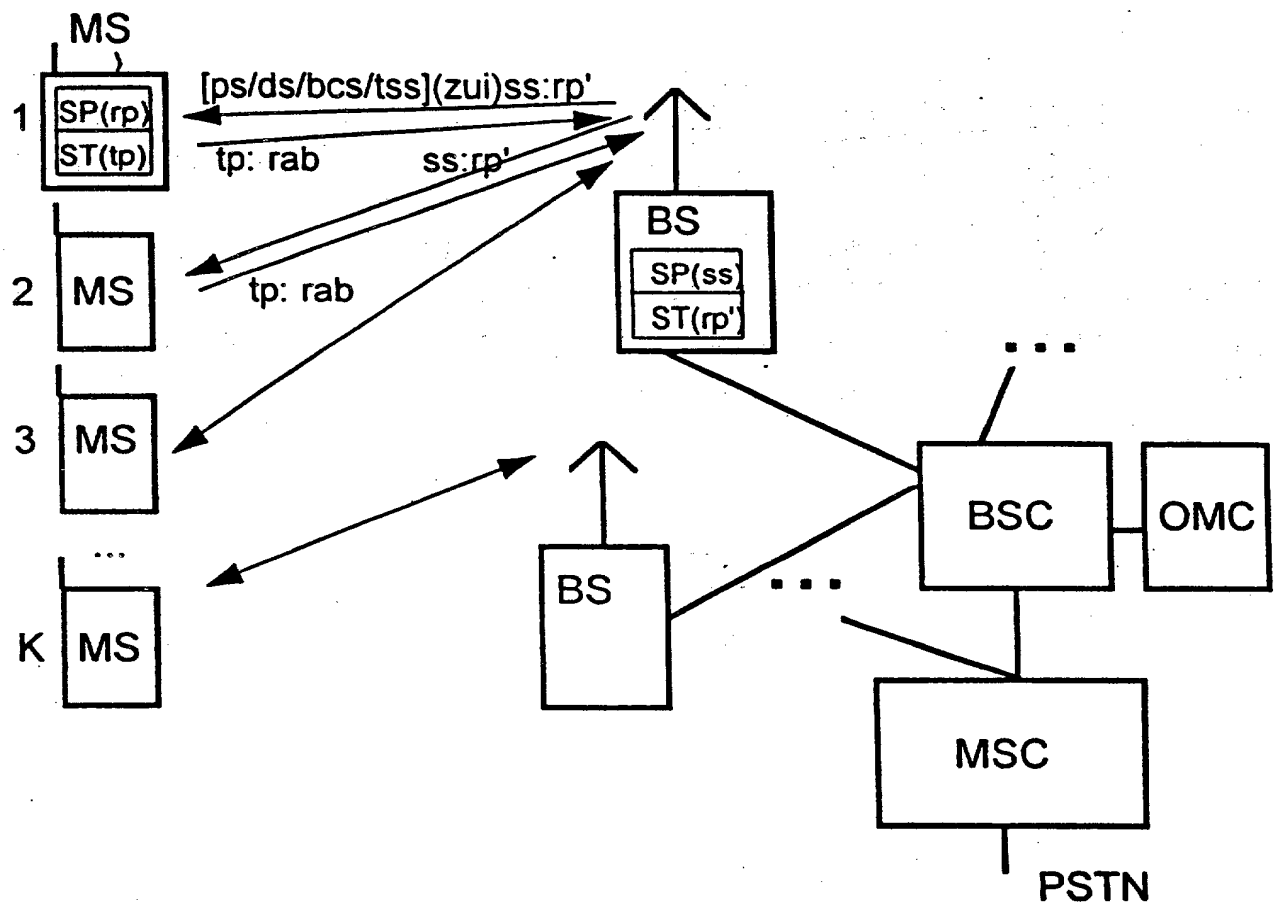

MS
1
SP(rp)
ST(tp)
[ps/ds/bcs/tss](zui)ss:rp'
tp: rab
ss:rp'
2
MS
tp: rab
BS
SP(ss)
ST(rp')
3
MS
...
K
MS
BS
BSC
OMC
MSC
PSTN

FIG 2

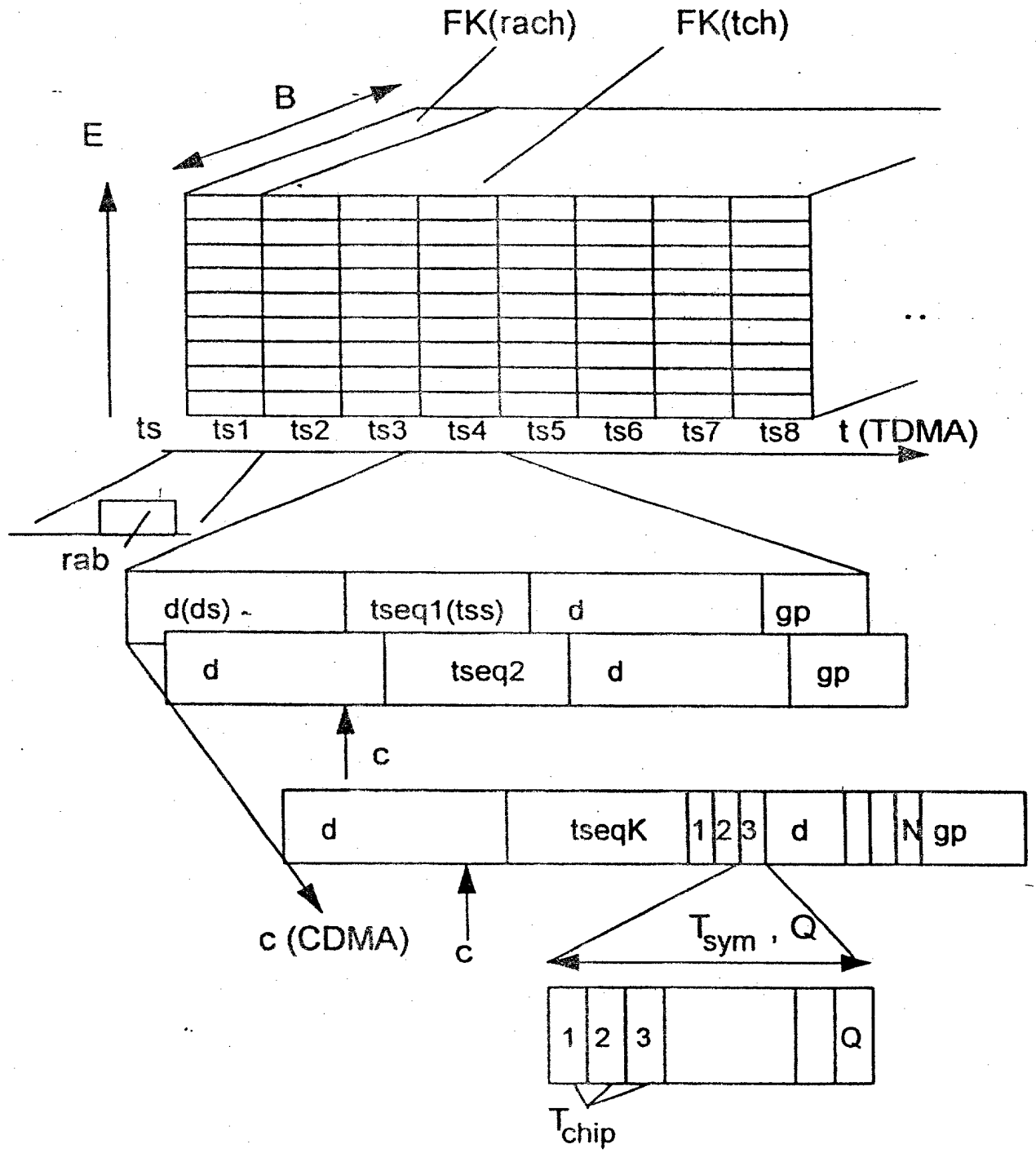

FK(rach)
FK(tch)
B
E
ts
ts1
ts2
ts3
ts4
ts5
ts6
ts7
ts8
t (TDMA)
rab
d(ds)
tseq1(tss)
d
gp
d
tseq2
d
gp
c
d
tseqK
1
2
3
d
N
gp
c (CDMA)
c
T_{sym} , Q
1
2
3
Q
T_{chip}

FIG 3

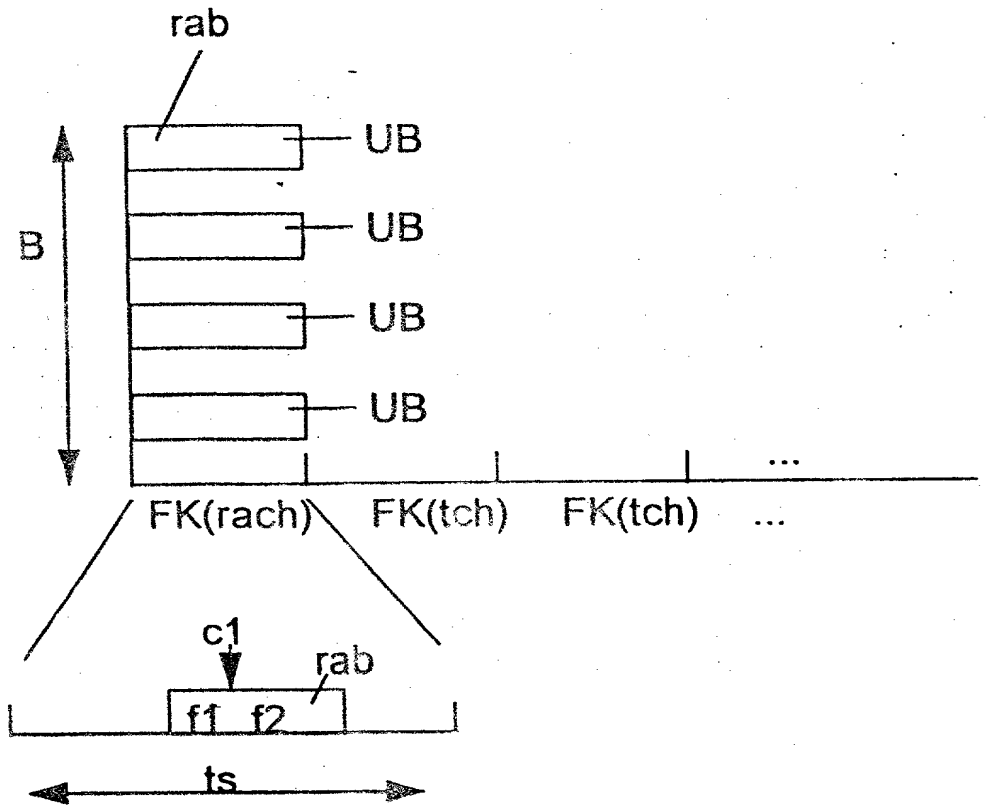
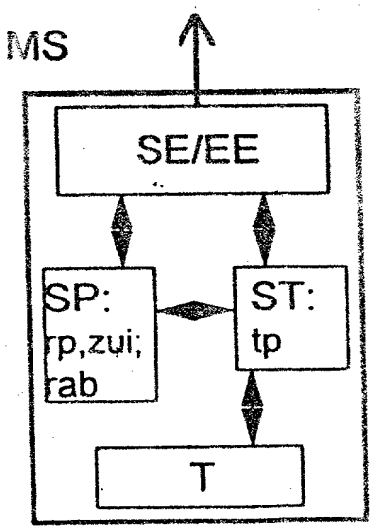
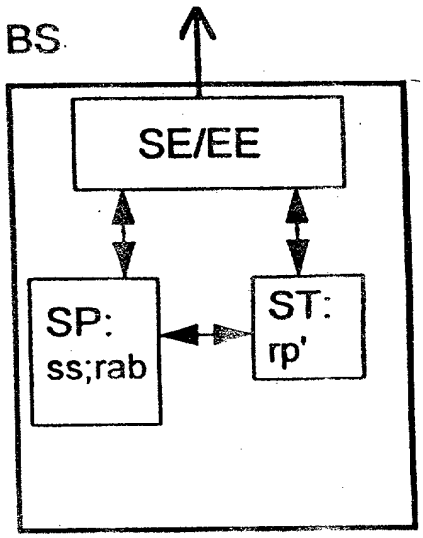

rab
UB
UB
UB
UB
B
...
FK(rach)
FK(tch)
FK(tch)
...
c1
rab
f1 f2
ts

FIG 4


MS
SE/EE
SP:
rp,zui;
rab
ST:
tp
T


BS
SE/EE
SP:
ss;rab
ST:
rp'

Declaration and Power of Attorney For Patent Application
Erklärung Für Patentanmeldungen Mit Vollmacht
German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

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Verfahren, Mobilstation und Basisstation zum Verbindungsaufbau in einem Funk-Kommunikationssystem

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As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

_____
_____
_____

the specification of which

(check one)
☐ is attached hereto.
☐ was filed on _____ as PCT international application PCT Application No. _____ and was amended on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

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Priorität beansprucht

			Priority Claimed	
197 47 451.9	Germany	27. Oktober 1997	☒	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35. United States Code. §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occured between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhängig, aufgegeben)	(Status) (patented, pending, abandoned)
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POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

And I hereby appoint

Messrs. John D. Simpson (Registration No. 19,842) Lewis T. Steadman (17,074), William C. Stueber (16,453), P. Phillips Connor (19,259), Dennis A. Gross (24,410), Marvin Moody (16,549), Steven H. Noll (28,982), Brett A. Valiquet (27,841), Thomas I. Ross (29,275), Kevin W. Guynn (29,927), Edward A. Lehmann (22,312), James D. Hobart (24,149), Robert M. Barrett (30,142), James Van Santen (16,584), J. Arthur Gross (13,615), Richard J. Schwarz (13,472) and Melvin A. Robinson (31,870), David R. Metzger (32,919), John R. Garrett (27,888) all members of the firm of Hill, Steadman & Simpson, A Professional Corporation.

19

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Staatsangehörigkeit Bundesrepublik Deutschland	Citizenship
Postanschrift Paderborner Str. 8	Post Office Addess
D-10709 Berlin Bundesrepublik Deutschland	
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Staatsangehörigkeit Bundesrepublik Deutschland	Citizenship
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D-82515 Wolfratshausen Bundesrepublik Deutschland	

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).

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Unterschrift des Erfinders Datum	Inventor's signature Date
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D-59872 Meschede Bundesrepublik Deutschland	
Voller Name des vierten Miterfinders (falls zutreffend):	Full name of fourth joint inventor, if any:
Unterschrift des Erfinders Datum	Inventor's signature Date
Wohnsitz	Residence
Staatsangehörigkeit	Citizenship
Postanschrift	Post Office Address
Voller Name des fünften Miterfinders (falls zutreffend):	Full name of fifth joint inventor, if any:
Unterschrift des Erfinders Datum	Inventor's signature Date
Wohnsitz	Residence
Staatsangehörigkeit	Citizenship
Postanschrift	Post Office Address
Voller Name des sechsten Miterfinders (falls zutreffend):	Full name of sixth joint inventor, if any:
Unterschrift des Erfinders Datum	Inventor's signature Date
Wohnsitz	Residence
Staatsangehörigkeit	Citizenship
Postanschrift	Post Office Address

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).